A SUSTAINABILITY FRAMEWORK FOR ENHANCING THE LONG-TERM SUCCESS OF LULUCF PROJECTS

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Abstract. Collateral impacts of land use and land-use change and forestry (LULUCF) projects, especially those concerning social and environmental aspects, have been recognized as important by the Marrakech Accords. The same applies to the necessity of assessing and, if possible, of quantifying the magnitude of these impacts. This article aims to define, clarify and structure the relevant social, economic and environmental issues to be addressed and to give examples of indicators that ought to be included in the planning, design, implementation, monitoring, and *ex post* evaluation of LULUCF projects. This is being done by providing a conceptual framework for the assessment of the sustainability of such projects that can be used as a checklist when dealing with concrete projects, and that in principle is applicable to both Annex I and non-Annex I countries. Finally, a set of recommendations is provided to further develop and promote the proposed framework.

1. Introduction

Parties to the United Nations Framework Convention on Climate Change (UNFCCC) accept that human-induced climate change is occurring and that there is a need to reduce its adverse effects. To face these effects two main ways have been identified: mitigation and adaptation. Mitigation concentrates on reducing GHG emissions and on enhancing sinks (the means by which GHGs are removed from the atmosphere); while adaptation refers to any adjustment in ecological or social systems in response to the actual or expected impacts to climate change. Both ways are to be complementary to each other and this implementation should be in line with sustainable development.

Commitments to mitigate climate change were agreed upon in the Kyoto Protocol (UNFCCC, 1997), which was ratified in November 2004. According to the Kyoto Protocol countries within Annex I of the Convention committed themselves to reduce 5.2% of the GHG emissions compared to the baseline year of 1990. To

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achieve this commitment an Annex I country can combine internal measures with the use of the so-called flexible mechanisms. Through these mechanisms an Annex I country can acquire an amount of emission reductions that occurred in another country. The Kyoto Protocol defines three Flexible Mechanisms: Joint Implementation (Art. 6), the Clean Development Mechanism (Art. 12) and International Emissions Trading (Art. 17).

The participation of the sector of Land Use, Land Use Change and Forestry (LULUCF) in the Kyoto Protocol has been regulated by the following decisions:

- COP-7, 2001, "Marrakesh Accords" (UNFCCC, 2002a, 2002b):
  - Dec. 11/CP.7: "Land use, land-use change and forestry";
  - Dec. 17/CP.7: "Modalities and procedures for a clean development mechanism as defined in Article 12 of the Kyoto Protocol";
- COP-9, 2003 (UNFCCC, 2004a):
  - Dec. 19/CP.9: "Modalities and procedures for afforestation and reforestation project activities under the clean development mechanism in the first commitment period of the Kyoto Protocol";
- COP-10, 2004 (UNFCCC, 2005):
  - Dec. 14/CP.10: "Simplified modalities and procedures for small-scale afforestation and reforestation project activities under the clean development mechanism in the first commitment period of the Kyoto Protocol and measures to facilitate their implementation";
  - Dec. 15/CP.10: "Good practice guidance for land use, land-use change and forestry activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol".

In these decisions the compatibility of LULUCF activities with sustainable development is seen as a key element to ensure the long-term success of any effort to mitigate climate change. However, many issues remain unsolved in the decisions, such as what is meant with sustainable development, who is responsible for guaranteeing it, and how to measure and monitor it.

Sustainable development is commonly defined as development that meets the needs of the present without compromizing the ability of future generations to meet their own needs (Brundtland, 1987). In the forestry sector the concept of sustainability is much older and gradually developed from the concept of sustained yield, which refers only to a forest's productive function, towards the concept of Sustainable Forest Management (SFM), which includes ecological, socio-economic, socio-cultural and institutional aspects as well (Frey, 1996).

For the purpose of the Kyoto Protocol the definition of sustainable development is within the responsibility of each Party. Requirements for demonstrating the

relationship between LULUCF activities and sustainable development have only been agreed for project activities under the CDM. For internal measures within Annex I countries as well as for activities within the Joint Implementation mechanism sustainability has been barely mentioned.

Before being validated LULUCF-CDM project developers have to demonstrate that LULUCF activities are in line with the regulation for sustainable development provided by the host country, and that no significant negative environmental or socio-economic impact is expected as a result of the project. If such an impact is to be expected, project developers have to explicitly include it in the monitoring plan, and the corresponding indicators will be considered during verification (Dec. 19/CP.9). However, there is no guidance that allows monitoring the contribution of LULUCF activities to sustainable development.

An alternative way to demonstrate the relationship between forestry activities and sustainable development is certification according to one of the many existing schemes. In the forestry sector the term "certification" is known as the process of independent verification that forest *management* has reached the level required by a given standard (Higman et al., 1999). Shortly after the UNCED Conference in Rio de Janeiro (1992) many initiatives to develop standards with criteria and indicators (C&I) of SFM emerged (Castañeda, 2000), mostly within the framework of an international initiative (Castañeda, 2001). The aim of standards ranged from evaluation of national policies (e.g. Helsinki process, Montreal process) to evaluation and certification at Forest Management Unit (FMU) level (e.g. FSC, PEFC).

Comparative studies of these sustainability standards for forestry were made, but most of these studies (e.g. Hahn-Schilling et al., 1994; Hornborg, 1999; Nsenkyiere and Simula, 2000; NABU, 2000; FERN, 2001) did not focus on differences in structure and contents, but merely on differences in the proposed certification procedures. In a comparative study of 164 standards for SFM worldwide, Holvoet and Muys (2004) found that differences between standards are substantial and can mainly be explained by differences in the level of application and in geographical origin. Standards developed for the national level are less detailed and typically contain monitoring aspects, while standards for the FMU level include concrete aspects of operational management. Standards developed in the South emphasize the socio-economic aspects of sustainability, while standards from the North emphasize the ecological functions and the need for research-based information. But typical for almost all standards is that they are poorly structured and that they make an arbitrary selection of principles, criteria, and indicators.

Within the Clean Development Mechanism, "certification" in relation to LULUCF activities has been defined as: "*the written assurance by the designated operational entity that an afforestation or reforestation project activity under the CDM achieved the net anthropogenic greenhouse gas removals by sinks, since the start of the project, as verified*" (FCCC/CP/2003/6/Add. 1, Dec. 19/CP.9).

Unlike the case of forestry certification, certification within the CDM is merely related to the existence of a substance in a certain concentration (carbon in e.g. biomass) in a determined area and according to scenarios defined at the beginning of the project (baseline and project scenario). This certification within the CDM, which also involves the implementation of a monitoring plan and verification, says nothing on the performance of a project regarding sustainability or sustainable development.

It is difficult to foresee the future use of forestry certification in LULUCF activities as a manner to monitor sustainable development. The first reason is that such activities are already involved in a process that is supposed to be in line with sustainable development (mitigation to climate change). Further, for LULUCF-CDM activities, it appears that it would be difficult for these projects to afford a certification process under, say, FSC standards in addition to all their other costs.

This illustrates the need for a sustainability framework as a solid basis for planning, implementation and evaluation of LULUCF activities. Such a framework can be used as a guide for design and implementation toolkits (e.g. ENCOFOR, www.joanneum.at/encofor), for project developers, as well as for Parties. Country-specificity should be developed according to the specific context. Further, the sustainability framework can be used as the basis for an evaluation standard (e.g. CCBA standard) and for future cross-country research on the real impact of LULUCF activities on sustainable development.

In order to pave the way towards a more comprehensive and systematic assessment of LULUCF projects along their life cycle, this article intends to structure those social, economic and environmental issues that play a significant role during the life span of a LULUCF project. In particular, this article firstly proposes a sustainability framework for the assessment of LULUCF projects along their entire life span. The proposed framework is ethics-based (Peet and Bossel, 2000), which means that it aims at creating sustainable projects, in which credibility and legitimacy are enhanced by applying a variety of institutional mechanisms that facilitate communication, translation and mediation across boundaries (Cash et al., 2003) between project investors in the North and host communities in the South. Based on this framework we will define key social, environmental and economic issues that can be used as a basis for a project checklist. This kind of list can be useful for project developers as well as for project evaluators. Secondly, and based on some real world LULUCF project experience, the article presents specific recommendations on how to further develop and promote these issues in order to bring them into practical use for the design and management of sustainable LULUCF project activities.

The article also considers the formal decisions that have been taken by the Conferences of the Parties (COPs), and especially those embodied in the Kyoto Protocol, the Bonn Agreement, and the Marrakech Accords, as well as the most recent decisions concerning LULUCF activities in the CDM, which were agreed

during the COP 9 in Milan (2003) and COP 10 in Buenos Aires (2004). The authors propose and maintain the thesis that the issues discussed are valid both for Annex I and non-Annex I countries, while the concrete impact of a specific issue on the performance of a LULUCF project, as well as its conflict potential will depend on the specific situation of each project.

2. Sustainability Framework for LULUCF Projects

Considering our first objective, in this section we propose a hierarchical framework for the sustainability assessment of LULUCF projects (Figure 1). In developing it, we have been inspired by Lammerts van Bueren and Blom (1997), who developed a hierarchical framework for the formulation of C&I of SFM.

On top of the hierarchy is the overall goal to promote and implement *a sustainable LULUCF project*. One goal is to have a broad, qualitative statement about aims (Parris and Kates, 2003). The specific goal here corresponds to the ultimate objective of the Convention (UNFCCC, 1992, Art. 2). It is based on the recognition that any strategy aimed at achieving the stabilization of the world's climate should not provoke any other significant environmental, economic, or social burdens.

The *sustainability dimensions* form the next hierarchical level, making the sustainability goal more concrete. We have defined four dimensions: the social, economic, environmental and institutional dimensions. One could also define two

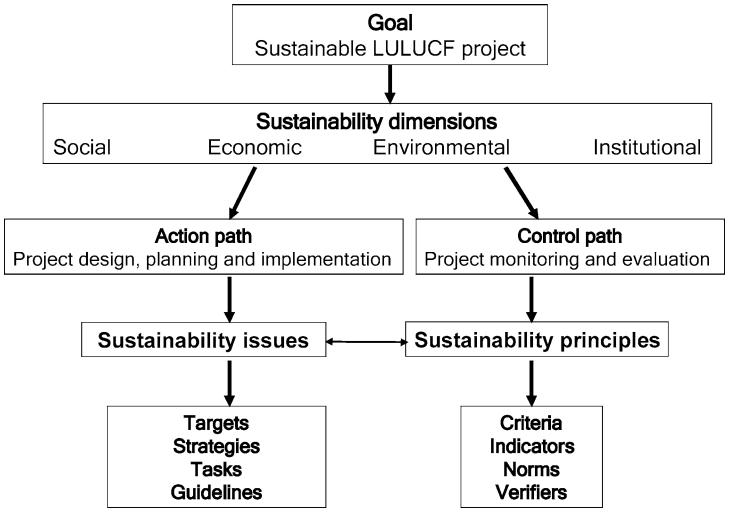

Figure 1. Structure of the hierarchical framework for the sustainability assessment of LULUCF projects.

dimensions, i.e. nature and mankind, but the problem then would be that environmental issues important for nature conservation, such as water availability, are equally important for mankind. In general, this interrelatedness makes a lucid categorical mapping very difficult. Another option could have been to let the dimensions coincide with the three pillars of sustainability generally accepted since the 1992 Earth Summit, i.e., the social, economic, and environmental pillars. The problem then would be that many aspects of sustainable development are being regulated, or institutionalized, suggesting that institutional aspects may form a dimension on their own. Such a fourth – institutional – dimension could include all *enabling conditions* to reach sustainability, such as human and property rights, laws and their enforcement, education and capacity building, etc. Lammerts van Bueren and Blom (1997) consider enabling conditions as non-essential aspects of sustainable forests and have proposed putting them lower in the hierarchy at the level of indicators (Figure 1), while others put them on the level of principles (e.g. FSC) or criteria (e.g. International Tropical Timber Organization – ITTO) (Table I). Although this is interesting reasoning, in this article an even more pragmatic way is followed. Throughout the article, we consider institutional aspects as belonging to the top of the hierarchy, i.e. to the dimension level (Table I), as has also been suggested by Ruitenbeek and Carter (1998). This corresponds to the fact that LULUCF projects, especially after the Marrakech Accords, are necessarily embedded in formal and informal institutional environments (Dec_s. 11/CP.7 and 17/CP.7).

Our sustainability dimensions coincide with the areas of concern in the CIFOR standard (1999) and with sustainability categories in the CCBA standard, which is a standard specifically focused on LULUCF project design (Table I). Other frameworks and standards, which are only meant for evaluation of forest management (and not for design or implementation) lack this hierarchical level of dimensions and directly go down from goal to principles (Lammerts van Bueren and Blom, 1997; FSC, 2000; Holvoet and Muys, 2004) or even criteria (ITTO, 1998) (Table I).

At the level of dimensions, the complexity of sustainability within a LULUCF project is understood as a *multiple objective optimization exercise*. Such an exercise aims to simultaneously maximize the stability of both nature and human society by optimizing and harmonizing among the social, economic, environmental and institutional dimensions, irrespective of whether they are in line with each other or diametrically opposed.

For each of the four dimensions a number of *issues* were identified (for an exact definition of the hierarchical levels used in this framework see Box 1). For each issue a corresponding *principle* is formulated. Issues and principles differ from each other in that issues have a positive, promoting connotation and are inviting for the implementation, whereas principles have a more normative connotation and allow for the evaluation of sustainability.

Box 1. Definition of technical terms used

Action Path

Issues are big topics concretizing the dimensions.

Targets are long-term planning objectives aiming at the implementation of a principle.

Strategies are long-term methodological lines followed to reach a target.

Tasks are concrete items of an action plan to implement strategies.

G*uidelines* are a practical set of instructions aiming to perform a specific task.

Control Path

Principles are basic rules of sustainable development, typically formulated as a commandment.

Criteria describe the state of the system under compliance with a sustainability principle. They are formulated as a statement to allow a verdict over the question of whether the evaluated situation is sustainable or not. Hence, a correctly formulated criterion requires a clear-cut 'yes' or 'no' answer.

Indicators are variables whose values indicate the level of compliance with a criterion. Indicators must be measurable variables sensitive to the compliance with a criterion.

Norms indicate a well-defined indicator value, setting the boundary between compliance and non-compliance with a criterion.

Verifiers are tools or instruments to measure an indicator.

Issues and principles are brought into practice through two parallel paths, the *path of action* and the *path of control*. The path of action emanates from the issues and includes project design, planning and implementation. The parallel path of control emanates from the principles and includes the necessary internal and external control mechanisms of monitoring and evaluation.

The path of action starts with the translation of each issue into a number of *targets* and *strategies* for reaching targets in the longer term. Targets and their derived strategies are then concretized into subsequent action plans, including detailed project *tasks*. These are implemented following a number of *guidelines* of best practice, adapted to the relevant level of time, scale and responsibility.

The path of control starts with the translation of each principle into *criteria*. The question of whether a criterion is met or not can be tackled by using suitable *indicators*. In cases where a minimal level of compliance is expected, *norms* can be defined in addition. Table II shows two examples that illustrate the functioning of the framework just described.

3. Shortlist and Description of Social, Economic, Environmental and Institutional Issues

Now that we have defined a framework for the design, implementation and evaluation of LULUCF projects, we can tackle the second objective of this paper, filling in the framework with a number of issues essential to sustainability in

TABLE I
Overview of sustainable forestry assessment schemes

	Initiatives aimed at evaluating sustainable forest management				Initiatives aimed at improving the quality of the design and implementation of LULUCF activities	
Study	CIFOR (1999)	Holvoet and Muys (2004)	ITTO (2004)	FSC (2000)	CCBA (2004)	This framework
Aim	Generic template for promoting SFM	Reference checklist for comparison between standards	Assessment of management of tropical forests (natural forests and plantations)	Certification of forest management at FMU level	Standards/certification for project design considering climate, community & biodiversity projects	Checklist for designing, implementing and monitoring LULUCF projects under the Kyoto Protocol
Area of concern		*Principles*	*Criteria and Indicators*	*Principles*	*Categories*	*Dimensions*
	Policy	Policy, planning, legislation and facilities	Enabling conditions for SFM	Compliance with laws and FSC principles Management plan Monitoring and assessment	General	Institutional
	Ecology	Area, vitality and state	Extent and condition of forests Forest ecosystem health	Environmental impact		Environmental
		Biodiversity and ecological processes		Maintenance of high conservation value forests	Biodiversity	
		Protective functions	Biological diversity Soil and water protection		Climate change mitigation	
	Production of goods and services	Productive function, forest exploitation and forest regeneration	Forest production	Plantations		Economic
		Economic viability, local economy	Economic, social and cultural aspects	Benefits from the forest		
	Social aspects	Social and cultural well-being of stakeholders		Community relations and workers' rights	Community	Social
				Indigenous people's rights Tenure and use rights and responsibilities		

TABLE II
Examples for the social and environmental dimension to be used in the hierarchical framework for design, planning, implementation, monitoring and evaluation of LULUCF projects

Hierarchical level Aim Dimension	Example 1 Sustainable LULUCF project Social	Example 2 Sustainable LULUCF project Environmental
Action Path		
Issue	Stakeholders' well-being	Ecosystem protection
Target	Project workers' safety	Erosion control
Strategy	Training	Soil erosion prevention
Task	Organization of demonstration and training sessions for forest workers on safety prescriptions	Preventive erosion control during road construction works
Guideline	Best practice guidelines on work safety	Guideline for good environmental practice concerning the protection of stream flows during road construction works
Control Path		
Principle	The well-being of all stakeholders shall be maintained and, where appropriate, improved	The protection function shall be maintained and, if appropriate, enhanced
Criterion	Permanent safety training of forest workers is organized	Soil erosion is minimized
Indicator	Number of work accidents/month	Annual sediment loss in tonnes/ha
Norm	Maximum 1 accident per 100 person-months	Maximum soil loss = 10 tons/ha/year
Verifier	Statistics from local community health center	Calculation of USLE (Universal Soil Loss Equation)

the context of land use and climate change policy. Based on project experience gained in developed and developing countries as well as from policy-making we have identified a set of specific issues along the social, economic, environmental and institutional sustainability dimensions that are considered important. The identified issues are short-listed in Table III and further elaborated in the following sections. A next step, beyond the scope of this article, will be the further elaboration of these issues into a standard of principles, criteria and indicators.

Due to numerous cross-cutting aspects, the boundary between social, economic, environmental and institutional issues is often blurred (e.g. UNDP, 2000). Some aspects can be discussed jointly for all issues, e.g. the cumulative effect of all projects vs. the effect of a single project (the impact of a single project may be negligible, whereas the cumulative impact can be significant).

TABLE III
Shortlist of sustainability issues relevant for LULUCF activities in the framework of the Climate Change Convention

Sustainability dimensions			
Social	Economic	Environmental	Institutional
Stakeholder identification	Financial performance	Greenhouse gas balance	Institutional agreements
Social process	Carbon finance	Ecosystem integrity	Legislation on land tenure and land-use rights
Communication	Wealth distribution	Sustainable productive capacity	Institutional capacity
Credibility	Local employment creation	Biodiversity	Institutional skills to negotiate and concert
Capacity building	Enhancement of the local/regional economy	Protective functions	Managerial, infrastructural and technological capacity
Participation and equity	Valuation of environmental externalities		

3.1. SOCIAL ISSUES

For the social dimension we have identified six issues to be tackled: (1) identification of social groups and social system; (2) social process; (3) communication; (4) credibility; (5) local capacity building; and (6) participation and equity.

(1) Identification of Social Groups and Social System. Considering a society as a system, the social dimension refers to the interaction among different social groups, and their interactions with the rest of the system. Social groups result from classifying stakeholders according to specific variables (e.g. income level, land tenure, education level), or by combining such variables. In a given region, project developers can find different groups – such as indigenous people, settlers and concessionaires. Each of these social groups will have specific interests and roles, and will be differently affected by the proposed LULUCF measures (Robledo and Blaser, 2001). Project developers have to be aware of the possible presence of different interests among the affected social groups in the project region, their perception of opportunities and necessities, their understanding of the problem and their acceptance of the proposed measures to solve the problem. Project developers should also be able to understand the functioning of the social system by recognizing possible interactions between stakeholder groups (Merbatu, 1998; Parris and Kates, 2003). It includes the identification of potential conflicts and synergies as well as the understanding of the influence that different social groups can have on the project. In some cases project developers should define a *target group* of the project, and define ways to enhance its participation, to distribute project benefits, and to establish strategies that diminish inequities and reduce potential conflicts.

(2) Social Process. Planning, implementing and monitoring LULUCF project activities are embedded in a social process in which social groups should interact with project developers. It should be clear that the main goal of such a process is the improvement of the livelihood, including all its capitals (Kelly, 1998). Such a social process can be observed according to the main stages of the project itself (Figure 2): (i) Formulation and information to the involved social groups; (ii) Adaptation of proposed measures after negotiation with the social groups involved; (iii) Decision-making understood as a finalization of concerting interest and priorities of all stakeholders; (iv) Implementation of LULUCF activities; and (v) Monitoring. Four issues determine this process: Communication between project developers and the social groups, credibility of the project developers as well as the representatives of the social groups, capacity building and participation and equity. The success of the project depends in a good portion on the ability to consider these issues in reducing social conflicts and increasing social benefits of the project.

(3) Communication. Diffusion of innovation theory (Rogers, 1995) is very useful to better understand how (subjectively) innovative ideas, such as LULUCF projects, are spread and adopted among social groups. Different adopter categories,

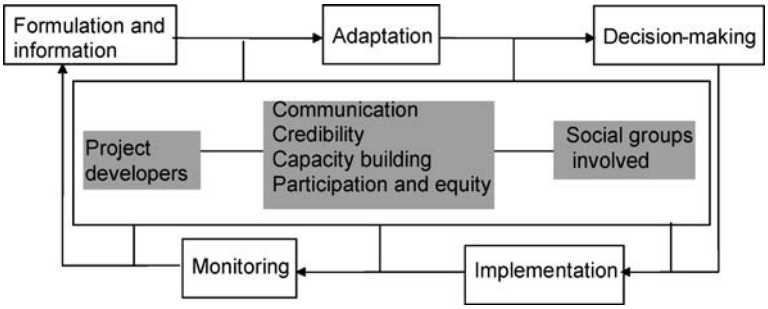

Figure 2. Project development presented as a social process (framed boxes) steered by the main issues to be considered (shaded boxes).

for example, use different communication channels, and an interesting finding of many empirical studies is that in the diffusion process interpersonal communication tends to be relatively less important for earlier adopters than for later adopters of an innovation (the opposite applies to mass media communication channels). Besides, the rate of adoption of an innovation depends on many factors, such as the (in all instances perceived): *relative advantage* (benefit gained compared to the idea or situation it supersedes), *compatibility* (with existing values, past experiences, and adopters' needs), *complexity* (for understanding and/or implementing and using), *trialability* (e.g. experimentation on a smaller scale), and *observability* of the innovation (to others). Also important is the issue of whether the decision about the innovation is optional and taken by an individual, or taken consensually by some collective body, or by some authority (on the basis of power, status, or technical expertise).

Communication patterns can differ considerably, depending on tradition, access to and local acceptance of media (e.g. radio, television, oral tradition). Considering communication implies, among other aspects, understanding local patterns to transmit information, to gain access to media, as well as to find ways to improve communication between local social groups and project developers. By improving communication patterns, project developers will promote discussion on controversial elements of the project during the design phase. At this step it is easier to find solutions and to promote commitments than during the actual implementation phase. Project developers should consider the elaboration of a communication strategy that allows different social groups affected by a LULUCF project to participate in the process of project design.

(4) Credibility. In order to promote a common problem and solution understanding, project developers should be able to mobilize affected social groups. Mobilization depends on the experience and credibility that project developers can demonstrate to the different social groups. In order to improve local confidence, project developers should seek strategic alliances with local institutions and opinion-leaders, which are both credible and have experience at the local level.

Through such alliances project developers can mobilize different social groups to participate in the project and also get commitments.

(5) Local Capacity Building. Capacity building increases the local ability to understand the problem, to propose technical, institutional and social measures and to include local capacities during the LULUCF project cycle. Through capacity building the understanding of a specific problem will be promoted for social groups and the needs and preferences of each social group will be better defined. In this sense capacity building not only refers to training in technical measures, but also to the promotion of local opinion leaders, which are essential for fostering the acceptance of LULUCF projects. Using and promoting local communication patterns and offering capacity building and exchange for local social groups can be more expensive at the beginning of a LULUCF project than towards the end because of learning effects (e.g. Abell and Hammond, 1979). Nevertheless, such investments are paramount in order to warrant a certain degree of social acceptance for technical measures.

(6) Participation and Equity. Participation of affected social groups in a LULUCF project depends on the local socio-cultural structures and involves many different topics. Such topics include the access to project information, project formulation and decision-making, or to capacity building. The consideration of these structures and fields allows project developers to design participation mechanisms for a project in a better way. Through these mechanisms the interests and needs of social groups will be considered during the project planning and implementation phases, and will be taken into account for the designated monitoring and verification processes. Moreover, participation of social groups helps to encourage project transparency and to promote the empowerment of local social groups.

Equity can be understood under geographical or under social considerations. From a geographical point of view equity refers to the regional and subregional distribution of projects. In the Annex to Dec. 17/CP.7 it is clearly agreed that the Conference of the Parties (COP) on report by the Executive Board (EB) should review equitable geographic distribution and identify systematic or systemic barriers for an equal spread of CDM projects (UNFCCC, 2002b, Add.2). Social equity, in contrast, should be considered by project developers, in that they should promote a fair distribution of the benefits and disadvantages of a project between the affected social groups. As equity concerns are at the same time subjective and also essential for sustainability, project developers should define participatory mechanisms beyond the design phase.

3.2. ECONOMIC ISSUES

LULUCF-CDM projects have to take into consideration various economic aspects included in the modalities and procedures both for general CDM projects (Dec. 17/CP.7) and specifically for afforestation and reforestation project activities

(Dec. 19/CP.9). Among these aspects are: Restrictions for Annex I public ODA[1] finance of a CDM project, sharing of proceeds for adaptation and administrative expenses of the CDM, transaction costs for completing the project cycle (design, validation, registration, monitoring, verification, certification and issuance), and the financial approach for establishing the baseline. A project's financial situation is also influenced by indirect impacts from other aspects, such as the modality of non-permanence that is chosen in the project, or the restricted amount of credits from A&R[2]/CP CDM projects that Annex I countries can use for compliance (Art. 7b of Dec. 17/CP.7), implying a cap on certificate demand.

All these aspects affect the economic sustainability of a LULUCF project, changing its financial structure (income, costs, revenues), or imposing restrictions on projects to be eligible or approved as a CDM project. For example, the share of proceeds, the transaction costs of the project cycle, and the capped demand for credits from A&R all increase the costs of a project and reduce the expected revenues from project financing. On the other hand, provisions such as the restriction of ODA funding affect the potential sources for project financing and could eventually become a barrier for the effective implementation of a project in regions with restricted access to the capital market.

The economic approach of establishing a baseline and additionality is not directly included in this dimension. The reason is that both concepts are more related to the environmental dimension, since they constitute ways to ensuring that the project will have real and additional GHG mitigation benefits. On the other hand, Decisions 17/CP.7 and 19/CP.9 do not impose the economic approach of the baseline and additionality test as the only way to address these issues. Other analyses were included as well, such as historical, technological, and barrier analysis. (e.g. Executive Board Additionality Toolkit; UNFCCC, 2004b).

Sustainability in the economic dimension is closely related to the economic impacts that the project generates to the different interest groups through the local, regional, or national markets. In this section we present a number of issues that covers not only the above aspects, but also other positive and negative economic impacts that an A&R CDM project can produce, and consequently, that affects its economic sustainability.

Just as for the social and environmental dimensions, LULUCF projects can have both positive and negative economic impacts. Besides, the positive impacts may comprise 'avoided negative impacts' (e.g. preservation of a forest that can be used for timber harvesting that would otherwise have been cut down). We have singled out the following six localized issues to be considered in our framework along the economic dimension: (1) financial performance; (2) carbon finance; (3) wealth distribution; (4) local employment creation; (5) enhancement of local/regional economy; and (6) valuation of project environmental externalities.

The issues covered require an integrated analysis both of the project itself, as well as its impact beyond its boundaries. Besides, apart from these essentially local impacts, macroeconomic impacts may also become relevant, such as changes

in import patterns (e.g. of fuels or timber; e.g. Sathaye et al., 1999). Obviously, LULUCF projects have to have a certain (cumulative) size to be felt at the macroeconomic level. As our framework is more geared towards individual projects of small to medium scales, macroeconomic issues are left out of the analysis. Two other issues that we do not touch upon are induced technical change and technological spillovers, and economic impacts of increases in know-how in general (IPCC, 2000). From a methodological viewpoint, in such economic assessments it is common to account for external costs and benefits. Note, however, that many of these external effects, in essence, are concerned with environmental or social issues, but additionally have a certain impact on the economy. An example of an economic assessment that is part of an integrated decision support framework for the evaluation of forestry projects for GHG mitigation is provided by Garcia-Quijano et al. (2005). They use the MARKAL model to assess the investment and management costs of a project, together with non-market evaluation methods (such as travel cost method and contingent valuation method) and external cost estimates, all specific to some functional unit. Another example of an analytical framework has been provided by Vine et al. (1999, pp. 63f., 2001), which only considers socioeconomic issues and impacts as one lot, without much guidance as how to measure such impacts in practice, and focuses more on the distinction between the tasks of monitoring, evaluating, reporting, verifying and certifying forestry projects for climate change mitigation. In what follows, we will discuss the six economic issues chosen in turn.

(1) Financial Performance. In the first place, a CDM forestry project has to make economic sense by itself. The first issue, financial performance, covers all the aspects that assure that the project will generate the economic flows expected by its owners. The principles, criteria and indicators of this issue will depend on the profitable or non-profitable nature of the project activity. A non-profitable project is expected to generate a minimum of cash flow revenues in order to cover at least the costs of the activities that help to reach the objectives. On the other hand, a profitable project has to generate dividends high enough to compensate for the opportunity cost of the capital invested. This issue makes it possible to analyze the impact of the transaction costs that accrue from designing and implementing a LULUCF project with respect to the project life cycle: external cost of validation, verification, certification, registration, as well as internal costs of designing and monitoring.

Financial performance can be measured with traditional financial indicators, such as Internal Rate of Return, Net Present Value, or Annualized Costs (Blank Leland and Tarquin, 2002), although Real Options modeling of investment opportunities constitutes a promising new avenue of appropriate project appraisal in situations of investment irreversibility, uncertainty, and where the timing of investment is flexible (Dixit and Pindyck, 1994).

(2) Carbon Finance. A CDM project has the unique characteristic that the capturing of carbon contributes to the project revenues, as the project owners generate and

sell temporary (short-term) or long-term Certified Emission Reductions – tCERs or lCERs. Note that the financial additionality check is only one approach for proving additionality and establishing the baseline scenario; the contribution of the revenues from carbon sequestration to the financial cash flow of the project is also of interest to explore, because it is an indication of the importance to the project's carbon benefits. Particularly, if a project has a low carbon share, the barriers for changing its performance related to the carbon storage (e.g. thinning and harvesting schedules) will be small and the long-term sustainability could be affected. For that reason an issue of the economic sustainability should analyze how the carbon revenues alter the project's financial indicators.

This issue should also cover the impact of the different permanence approaches in the carbon finance. lCERs and tCERs have different characteristics that could affect the way in which the carbon revenue is delivered to the project. Similarly, the expiration date and risk profile of lCERs and tCERs will produce a different market price for each unit (Dutschke et al., 2004).

(3) Wealth Distribution. The third issue, wealth distribution, is related to the economic impact of the project on the stakeholders. This is an important issue for developing countries, in which poverty alleviation is a major goal. For a wealth distribution analysis it is necessary to identify the social groups that the project will affect, including landowners, local communities, indigenous groups, government, and equity owners. The analysis covered by this issue should identify the impact of the project on the wealth[3] of each social group, and particularly of those with low income (Castro and Mokate, 1998). Wealth distribution analyses include the impact of the project on the income of qualified and unqualified workers, input suppliers, project owners, and government.

As payments for carbon credits can both increase and diversify local income, LULUCF projects of a significant cumulative size can have a significant impact on sustainable development in many regions. For instance, calculations made for the San Nicolas project in Colombia prove that just through the selling of CERs that arise from the project it will be possible to establish those agro-forestry systems that the local groups have defined as strategic (EcoSecurities, 2003). Other well-documented experiences, like the Noel Kempf project in Bolivia, or the different experiences made in recent years in Costa Rica, demonstrate that it is necessary to warrant the improvement of local income in order to effectively promote long-term good practices in the sector (Smith and Scherr, 2002).

Once the wealth distribution effect of a LULUCF project activity has been analyzed, equity principles and criteria could be developed, related to concerns about alleviation of poverty, income inequalities, and changing or supporting of the social status quo.

(4) Local Employment Creation. LULUCF projects tend to be labor-intensive, especially in developing countries, and thus can be an important source for creating and/or maintaining local employment for both skilled and, more importantly, unskilled workers. Different types of employment effects can be distinguished:

Direct employment results from the establishment and operation of a project and from resource production. In case of reforestation projects combined with bioenergy systems, for example, this refers to total labor necessary for crop planting and production, or the construction, operation and maintenance of biomass conversion plants, and for biomass fuel logistics. *Indirect employment* results from all activities connected, but not directly related to a project, such as those of supporting industries, services and the like. *Induced employment* arises from higher spending (investment and consumption) due to increased earnings from direct and indirect employment. The latter employment factor can be complemented through project-induced capacity building and technology transfer (e.g. participants in bioenergy and forestry activities learn skills they can transfer to other profitable activities).

(5) Enhancement of the Local/Regional Economy. This issue is related to the indirect impact of the project through the resources markets for both inputs as well as products. Depending on the relative project size, a project can affect prices and/or quantities of its inputs and outputs markets, having indirect effects on the corresponding suppliers and consumers. On a forestry project, the most important concerns are its impacts on the price and availability of land and labor inputs. Principles developed for this issue should cover, for example, land scarcity concerns. On the other hand, it is also important to trace the impact of the project activity on its output markets. The outputs of a forestry project will vary depending on its objectives (protection or wood production) as well as on its type (plantation, agroforestry or silvopastoral land use). The analysis should not only cover the project outputs but also the baseline scenario outputs. For example, if a project is replacing a cattle activity in the baseline scenario, the issue should be to analyze the impact of the project in the meat market. Principles and criteria considered for evaluating such a project should cover, for example, food availability and fuel wood supply.

For instance, in forestry and bioenergy projects and related activities many farmers would welcome the opportunity to sell forest and agricultural residues or purpose-grown energy wood or crops to long-term, steady consumers. Producing biomass for non-food purposes provides a new source of revenue that helps farmers to diversify their production. This reduces the vulnerability, say, to crop failures or declining crop prices, especially if the biomass is derived from trees – i.e. a secure standing asset that can be harvested as the demand arises. Tree planting, in particular of crop species such as those used in agro-forestry systems, can have rewards in terms of improved agricultural productivity and food security (sustainable agro-forestry), as well as some collateral environmental benefits such as the improvement of watersheds or soil conservation.

(6) Valuation of Environmental Externalities. Finally, a CDM project can have positive or negative impacts on the availability of non-market environmental resources and services, such as water, soil (erosion), biological diversity, a scenic view etc. Such impacts are commonly referred to as environmental externalities (Bator, 1958). Because environmental externalities are often not well captured by

traditional markets, it is necessary to make a specific valuation of them in order to assess the total economic impact of a project. Monetized valuation of environmental externalities allows for a comparison and aggregation of diverse environmental effects in a common monetary unit. Environmental economists have developed special techniques to value both negative and positive impacts of a project. Techniques include direct measures: contingent valuation and indirect valuation: travel costs, hedonic prices etc. (Freeman, 1993; Bateman et al., 2002). The issue will cover the quantification of the environmental costs and benefits of the project activity and its relation to other economic issues and financial indicators.

3.3. ENVIRONMENTAL ISSUES

The main environmental issue of GHG mitigation projects is of course the GHG balance. Within the UNFCCC framework many rules and guidelines on carbon accounting (baseline, additionality, non-permanence) exist, often inspired by the IPCC Good Practice Guidance for Land use, Land-Use Change and Forestry (Penman et al., 2003). But other environmental issues are hardly specified by the UNFCCC framework. The main guidelines here are Dec. 11/CP.7 on "Land use, land-use change and forestry" and Dec. 19/CP.9 on "Modalities and procedures for afforestation and reforestation project activities under the clean development mechanism in the first commitment period of the Kyoto Protocol". Annex B of Dec. 19/CP.9 specifies the content of the Project Design Document (PDD). According to this document the PDD should include the present environmental conditions including climate, hydrology, soils, ecosystems, and the possible presence of rare or endangered species and their habitats. It also should include an environmental impact assessment of the project activity including impacts on biodiversity, natural ecosystems, hydrology, soils, risk of fires, pests and diseases, and impacts outside the project boundary. Based on this document and inspired by the globally agreed criteria for sustainable forest management (FAO/ITTO, 1995; Castañeda, 2000), we finally defined five environmental issues: (1) GHG balance; (2) ecosystem area; vitality and condition; (3) sustainable productive capacity; (4) biodiversity and life support functions; and (5) protection function (including soil and water).

(1) GHG Balance. The GHG balance issue is essential in LULUCF projects, because making a positive contribution to this balance is their ultimate aim. Putting it as a principle, the overall GHG balance of the project should be positive. In the general framework of forest sustainability, however, this aspect is normally considered at the level of a criterion under the protection function of the forest, next to other protection functions, such as erosion control, control over the water flows, etc. (e.g. FSC principles for sustainable forest management (SFM), Helsinki and Montreal criteria for SFM). In the Kyoto context, however, it becomes a major principle on its own. This principle can then be further worked out in detail using a number of

criteria, which have been discussed in detail by other authors (Schlamadinger and Marland, 2000; Verbeiren et al., 2000; CCBA, 2004) and found their final form in UNFCCC Dec. 19/CP.9:

- *Additionality* of the project is demonstrated. It means that the actual net greenhouse gas removals by sinks are increased above the sum of the changes in carbon stocks that would have occurred in the absence of the project activity.
- The *baseline scenario*, i.e. the scenario that reasonably represents the sum of the changes in carbon stocks within the project boundary that would have occurred in the absence of the project activity, has been analyzed according to the prescribed methodologies.
- *Leakage*, i.e. the increase in greenhouse gas emission by sources outside the boundary of the project, but which can be measured and is attributable to the project (Dec. 19/CP.9), is by all means avoided.
- The project's *GHG mitigation performance* (the quantified level of GHG emission reduction) is monitored in accordance with Dec. 19/CP.9 and is satisfactory.
- It is recognized that carbon sequestration in forestry projects is not forever. *Non-permanence* is addressed by the issuance of tCERs (temporary certified emission reductions) or lCERs (long-term CERs).

(2) Ecosystem Area, Vitality, and Condition. The ecosystem area, vitality, and condition issue deals with the principle that the project should not lead to deforestation, ecosystem destruction, or any decline in ecosystem vitality and condition. LULUCF projects may promote or endanger the vitality of an ecosystem, depending on the project activities. Risks of fire, pests and diseases, and other calamities must be appropriately taken into account, and measures to minimize such risks incorporated into the management plan. In general, LULUCF projects offer potentially great opportunities for restoration and rehabilitation of forest lands, leading to an increase of ecosystem area, vitality and condition (ITTO, 2002).

(3) Sustainable Productive Capacity. The production issue is based on the so-called 'sustainable yield' principle, which means that ecosystem productivity should be maintained, forest regeneration should be secured, fluctuations in standing stock should be minimized, and sustainable harvest should be promoted. LULUCF activities can enhance diversification of products by establishing mixed species forests and promote longer rotation lengths. This enables the grading of wood products before sales into different qualities for different applications (e.g. fuelwood, wood for chipping or paper pulp, saw-timber of different qualities). Also the promotion of non-wood forest products (NWFP), such as mushrooms, resins and gums, fruits from the wild, etc. can reduce the stress on one specific product and offer income diversification and risk spreading as well (Peters, 1999).

(4) Biodiversity and Life Support Functions. The biodiversity issue aims at the conservation of biodiversity and the protection or restoration of the ecological processes sustaining biological diversity. This issue is part of a major concern for

a better coordination between the UNFCCC and the United Nations Convention on Biological Diversity (UNCBD) (Brown, 1998; Orlando and Smeardon, 1999). Schulze et al. (2002) have pointed out that major hotspots of biological diversity are at risk under the mandate of the UNFCCC, especially in the case of afforestations with exotic species, perhaps on land that never had any forest cover. But the problem is that there is very little experience with the monitoring of biodiversity in CDM afforestation/reforestation projects (Koellner and Sell, 2005). Formulated as a principle, biodiversity and ecological processes should be conserved and protected and, where appropriate, restored. Possible criteria figuring under this principle are:

- Existing biological, genetic and habitat diversity are maintained and conserved where necessary.
- Plantation forests do not replace natural (climax) vegetations with high biodiversity value, and demonstrate the need to decrease pressure on the natural systems by the creation of local socio-economic benefits.
- Habitats with specific biodiversity values (e.g. river banks, rocky outcrops) within the afforestation/reforestation zone are conserved and not afforested.
- Afforestation/reforestation makes maximal use of native species; exotics are subject to restrictions.
- The use of biocides, fertilizers, genetically modified organisms, and biological pest control species is strictly regulated.

(5) Protection Function. The protection issue includes the maintenance and strengthening of the environmental services provided by the ecosystem, such as soil and water conservation and climate regulation. Soil and water conservation includes watershed management and erosion control. Climate regulation includes evapotranspiration, microclimate and albedo, but excludes GHG balance, which is dealt with under the first environmental issue. In general, afforestation/reforestation is considered favorable for these ecosystem services due to the strong control of tree vegetation over energy, water and nutrient balances (Aerts et al., 2004). But in the case of eucalyptus plantations, the evapotranspirative control can be so high that it has a negative trade-off in terms of downstream water availability (Scott and Lesch, 1997; Jobbági and Jackson, 2004).

3.4. INSTITUTIONAL ISSUES

Institutional issues are strongly interrelated with the other issues described and integrate these in organizational structures. For example, while in the section on social issues we considered the effects that LULUCF project could have on the relationships among different social groups, in the present section we include the compendium of rules and institutions that regulate these relationships at the local, regional or national levels.

Institutional issues can be external (defined outside the project) or internal to the project. Issues *external* to the project are the (1) institutional agreements, (2) legislation on land tenure and land use rights, and (3) institutional capacity. Issues *internal* to the project consist of the (4) institutional skills to negotiate and concert and (5) managerial, infrastructural and technological capacity.

(1) Institutional Arrangements. Institutional arrangements refer to the set of policies, norms and regulations required to implement a mitigation strategy. The institutional frameworks required at the national and local level to accompany mitigation strategies constitute a huge challenge for the institutional capacity of countries or any other territorial bodies. After the Marrakech Accords countries are called to define an office to be responsible for dealing with mitigation to climate change at the national level. However, implementation of climate change mitigation activities are being undertaken under different ministries and often insufficiently coordinated. In the specific case of LULUCF projects the Ministries of Environment, Agriculture, Forestry and – especially in the case of bioenergy – Energy are the ones that are typically involved. National policies to reduce CO_2 emissions may undermine national policies to further develop the energy sector, or imply some rise in prices that can be politically undesirable or socially unsustainable. Even if such an office exists, coordination between authorities at the level of national legislation is required to be able to implement a real mitigation policy. To be sustainable LULUCF projects should be embedded in a coordinated environmental policy that considers mitigation to climate change on an equal footing with other goals.

(2) Legislation on Land Tenure and Land Use Rights. Legislation on land tenure and land-use rights surely comprises an institutional arrangement. However, due to the importance of this issue for the themes of this article, we propose to distinguish them from one another. According to the Marrakech Accords and to the Dec. 19/CP.9, the ownership of and access to carbon pools have to be clarified (UNFCCC, 2002b, Add. 1 and UNFCCC, 2004a, Add. 2).

Dealing with the ownership of and access to carbon pools is directly related to the legislation on land tenure and land use rights, as well as to the enforcement capacity of a given country. The host countries of LULUCF-CDM projects should take into account customary rights and the particular needs of local social groups directly involved in the project. Land tenure and land use rights refer to many forms that determine the property and possession status of land as well as the possible use of natural resources. Land tenure rights include public, private and community ownership, while rights of use include different agreements that allow specific social groups the access to specific resources (Higman et al., 1999). Some of these agreements cover concessions, collaborative management, or land renting. However, in many cases territories are just possessed by different social groups, without having any legally binding arrangements on property rights or the rights of use. Possession can be based on customary rights, which are sometimes

neglected in legal arrangements at the national or regional level (Blaser and Hussein, 2000). In those cases in which land tenure and land use rights are not properly arranged, or where the rights of local communities are not adequately recognized, LULUCF projects should prevent inequities by promoting new legal arrangements among the affected social groups. Because land tenure and land use rights are an important basis for LULUCF projects, a regime that gives equal consideration to customary rights and the needs of local social groups should be promoted by project developers.

(3) Institutional Capacity. Besides the existence of an appropriate institutional framework, countries need the capacity to enforce such a framework. This capacity has to be available not only at the national, but also at the very local level. In many countries interested in participating in LULUCF activities this issue represents a great challenge. In the past fifteen years transparency and governance in the forestry sector have become increasingly important issues for promoting sustainability. Multilateral agencies such as the FAO and the World Bank as well as bilateral cooperation agencies are committed to programmes aimed at promoting the enforcement of more sustainable forest legislation in developing countries (Forest Strategy of the World Bank – World Bank, 2004; FAO/ITTO, 1995; IGBP/IHDP, 1999). Institutional development towards a more sustainable forest sector has been promoted in many industrialized countries as well. LULUCF activities should be taken into account in these processes, so that the institutional capacity of countries allows the opportunities given through the mitigation strategy for the sustainable management of the forest resources to be used to the maximum.

(4) Institutional Skills to Negotiate and Concert. Concerning the institutional arrangements within the project, one of the most important issues is the ability of project developers to establish internal arrangements among the different stakeholders involved in the project (ITTO, 1999). This will create an internal institutional framework that supports long term success of the planned forestry activities. Such a framework, when agreed in a participatory manner, will increase the benefits of the project, will reduce the potential for conflicts and – most importantly – it will provide confidence to potential investors. Therefore project developers should improve their skills to negotiate with and establish a consensus among the different social groups involved in the project.

(5) Managerial, Infrastructural, and Technological Capacity. Concerning the institutional arrangements within the project, the developer should demonstrate sufficient capacity on the managerial, infrastructural, and technological levels to successfully implement the project and monitor its performance over the project's lifetime. The project should be managed using a regularly updated management plan, and progress should be communicated through transparent annual reporting. The project's development should be reported through a transparent annual reporting scheme, which also contains a detailed evaluation of the project's performance and financial management matters (e.g. spending of external funding and revenues from operation).

4. Policy Recommendations

Now that issues have been defined, a number of policy recommendations will be made to put this framework into practice. We are aware that this list can and should be further complemented by existing and future theoretical advances and practical (in-the-field) experience. In what follows, after providing some general recommendations, more specific recommendations concerning sustainability issues will be put forward.

4.1. GENERAL RECOMMENDATIONS

- Issues and the corresponding principles are universally applicable.
- Targets, strategies, tasks and guidelines are project-specific and must be developed during the project design and planning phases.
- Criteria lists can be provided, but country- and area-specific circumstances will influence the set of criteria chosen.
- Indicators should be globally harmonized to the maximum extent possible, in order to be able to compare project performance.

4.2. RECOMMENDATIONS CONCERNING SOCIAL ISSUES

- For the planning and implementation stage project participants need to identify the interests of the social groups involved as well as the key social issues. Project participants should be able to actively influence the dynamics among these issues, in order to be able to optimally promote the project.
- Social issues have qualitative as well as quantitative components and, therefore, project target definitions should include both types. Hence at the planning stage project participants ought to define their goals in a qualitative as well as in a quantitative way.
- LULUCF project activities are embedded in a social process. In order to promote social acceptance and to implement and monitor projects the starting point of this process, i.e. the relationship between social groups and project developers as well as the local conditions and changes within this local framework, should be properly understood and assessed.

4.3. RECOMMENDATIONS CONCERNING ECONOMIC ISSUES

Economic impacts are manifold and may accrue at all levels of the economy (local, regional, national). Macroeconomic implications should be considered, provided they are discernible (there is a minimum size to projects that have an impact on the macro scale). Besides, it is important that the impacts are quantified in an

appropriate manner, and that the net value of the sum of positive and negative impacts is taken into account.

In developing principles for the project finance issue, the differences and similarities between a non-profitable project and a profitable project should be identified, in order to make them universally applicable. Both types of project need to have a balanced cash flow in which all costs are covered by revenues; and surpluses should be distributed to the stockholders in a profitable project, and benevolent goals in non-profit projects should be attained, each of them in the magnitude expected of it.

If project size is not significant relative to the size of a market, no market analysis needs to be carried out. A project will be considered significant if its operation changes prices on the market (inputs or outputs). For this analysis, it is critical to identify the relevant market depending on the project design: a project owner could supply wood to an international market and simultaneously could purchase an input on a local market or vice versa.

The externalities valuation issue is applicable to projects that have significant positive and/or negative environmental impacts. It is necessary to compare the magnitude of the externalities in order to assess its contribution to sustainable development. Environmental externalities should be identified and assessed in the environmental dimension. The issue should be developed and applied, having in mind that valuation techniques typically have high costs and could have a significant impact on the transaction cost of the projects. Similar valuation can be made for non-environmental externalities. For example, if a project constructs roads or infrastructure that benefits or affects communities beyond its boundaries, valuation techniques or cost-benefit analysis could be performed to assess the net economic impact of the infrastructure.

4.4. RECOMMENDATIONS CONCERNING ENVIRONMENTAL ISSUES

An important point of attention is that not only carbon sequestered in biomass should be taken into account. Afforestation can under certain circumstances lead to increased GHG emissions, for example, due to soil carbon oxidation following the drainage of swamps and peatlands (Hargreaves et al., 2003) or due to increased N_2O emission following intensive fertilization (Matson et al., 1992).

For the *action path*:

- A geographical information system should be created, used and updated, integrating inventory, monitoring, mapping, etc. of all environmental data concerning the project area.
- A project area should be suitable for afforestation, sufficiently productive to expect a positive GHG balance, and suitable tree species should be used. Project site selection and land suitability assessment should follow a state-of-the-art methodology (Muys et al., 2005).

- A participatory environmental impact assessment (EIA) should precede the project design and implementation, including present natural and environmental state, the predicted trends and mitigation plan to reduce potential negative effects. The CCBA standard (CCBA, 2004) is the best available checklist to perform this EIA.
- Environmental risk and uncertainty analysis must be integrated into the management plan.
- Guidelines for good environmental practice (e.g. for plantation establishment, road construction, harvesting practice) must be developed and implemented.
- The environmental management of the project area should be in line with local, national and international territorial conservation schemes, laws and conventions.

For the *control path*:

- Evaluation and assessment tools should use a set of indicators that covers all five environmental issues.
- Evaluation tools for monitoring and internal auditing can be flexible and dependent on experience and data availability.
- Assessment tools for certification should be standardized to a maximum in order to make environmental effects of different projects and project areas comparable. Inspiration can be found in the universal land use impact assessment method proposed by Peters et al. (2004) and in the CCBA standard (CCBA, 2004).
- It can be elucidating to express environmental impacts of a project per functional unit of 1 ton of CO_2 emission reduction, such as illustrated by Garcia-Quijano et al. (2005).
- Indicators should preferably fulfill the following conditions:
  - Be cost effective and simple in measuring;
  - Be universally applicable (rule for assessment, recommendation for monitoring);
  - Be quantitative rather than qualitative;
  - Be spatially explicit;
  - Do not be arbitrarily chosen, but instead based on a solid ecological concept. We propose choosing indicators compatible with the ecosystem exergy concept, as suggested by the working group on land use impact assessment of COST E9 (Life Cycle Assessment for Forestry and Forest Products; cf. Muys and Garcia, 2002);
  - Measure as much as possible at the endpoint (measuring preferably effects instead of impacts);
  - Be low in numbers;
  - Integrate the time aspect;
  - Distinguish reversible from irreversible impacts.

4.5. RECOMMENDATIONS CONCERNING THE INSTITUTIONAL DIMENSION

- Countries need to define institutional strategies to achieve the UNFCCC objectives. Strategies facing this institutional challenge deal with institutional capacity building, and are aimed at defining institutional agreements that make it possible to create common task forces or coordination offices for climate change. These could treat the whole climate change theme in a coordinated way and be responsible for reporting at different occasions and to various other institutions.
- Legal frameworks that regulate land tenure and ownership of environmental services are essential for designing and implementing LULUCF project activities. This requires a certain level of coordination between the responsible institutions at the national and sub-national level. In many countries such coordination can only take place as a result of a process of institutional development. Governments as well as bilateral and multilateral agencies should consider these elements in their programs.
- Institutional capacity building is strongly related to the necessary changes in the legal framework of a country. Therefore, it is necessary again to consider equity and land tenure and land use rights as further central institutional aspects of LULUCF. From this point of view, countries should in turn check their legal frameworks against the possibility that existing mitigation potentials might be diminished or jeopardized by inappropriate laws. Another crucial point is the resistance of existing institutions against change and the time required to establish new, fully operational institutions.
- Institutional arrangements within the project should be transparent and should support participation and equity goals. In this sense responsibilities and benefit and burden sharing procedures should be agreed upon according to the project targets.
- Project progress should be reported on a regular basis and also contain an evaluation of the performance of the project and the management of the financial resources involved.
- Many developing countries probably do not have enough institutional capacity to ensure the sustainability of LULUCF activities. Bilateral and multilateral agencies interested in promoting the participation of LULUCF in the mitigation to climate change should consider these issues in their cooperation packages.

5. Summary and Outlook

In this article we have introduced a comprehensive conceptual framework for the assessment of LULUCF projects according to four sustainability dimensions: social, economic, environmental and institutional. We have then presented and analyzed

key issues regarding each dimension. Furthermore, we have introduced general principles for each of these issues. This establishes a general framework that can be used by LULUCF project developers as well as for monitoring the impact of such projects on sustainable development. However, in order to propose specific criteria and indicators, this general framework ought to be further developed, taking into account one's specific national and local situations. Additional research is needed to undertake this further development of the sustainability framework, as well as to be able to guide the application of the framework in practical work.

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Notes

[1]Official Development Assistance.

[2]Afforestation & Reforestation.

[3]The economic definition of wealth is related to the difference between the willingness to pay or the willingness to accept in a with-and-without project scenario.

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